

Renewable Energy: Geothermal power plants and geothermal heat pumps

GREEN Energy from the Earth



Svartsengi geothermal power plant, Iceland

Large scale natural geothermal power

Geothermal power plants focused on natural systems use the energy created by natural sources of heat and steam generated in the earth, particularly around active tectonic plates.

Areas of active and dormant volcanoes, frequent seismic activity, geysers, hot springs, underground rivers of magma, and other geological indicators of the earth's "hot spots", cause naturally occurring steam from underground. This steam from the earth runs generators in a **geothermal power plant**.

Large-scale **geothermal power plants** can be found in Iceland, Italy, Indonesia, the Philippines, Turkey, and the United States, among a few other countries.

In **Iceland**, geothermal energy sources are found everywhere. Geothermal energy is generated in areas around volcanoes, geysers, and hot springs from several **geothermal power plants** throughout Iceland.

The Larderello Geothermal Energy plant in Italy is the world's oldest large-scale geothermal power plant, first generating a sizable quantity of energy over 100 years ago. After many renovations over the last 105 years; Larderello Geothermal Energy is a complex of 34 **geothermal plants** now generating around 800 MW, producing around 2% of Italy's energy mix, and powering around 1 million Italian homes.

The **largest geothermal power plant** project in the world is a complex of 22 plants called The Geysers in California at a capacity of over 1.2 GW. The Geysers supplies energy to 5 surrounding counties in Northern California, sourcing geothermal energy (steam) from 350 different wells and a 4-mile deep magma chamber that spans over 30 square miles.



Larderello Geothermal Energy plant in Italy

EGS

Geothermal energy can also be produced through the use of man-made technology.

Enhanced Geothermal Systems (EGS), also known as **engineered geothermal systems** (hot dry rock geothermal), refers to a variety of engineering techniques used to artificially create similar systems as natural geothermal thermal resources (underground steam and hot water). These man-made geothermal systems are used to generate electricity, just like geothermal plants that are focused on natural systems. EGS is typically constructed into a large-scale operation when it is developed and implemented.

Geothermal Heat Pumps and Electric Heat Pumps

Geothermal energy has a micro application along with its macro-counterpart. This micro-form of geothermal energy is primarily in the form of **geothermal heat pumps**. Geothermal heat pumps regulate a building's temperature by the use of ground-source heating and cooling. Across the world, **geothermal heat pumps** are gaining popularity as a top choice for a clean and efficient renewable energy technology to heat and cool a building to augment/ replace traditional HVAC (heating ventilation and air conditioning) units.

A **geothermal heat pump** is an electrically powered unit that transfers energy to your property from heat energy underground (as opposed to an air source heat pump, which also heats and cools your property, but uses heat from above ground air). In the majority of locations worldwide, the temperature under the surface of the earth is consistently 10-15°C, producing a constant source of heat energy.

Geothermal heat pumps use this constant ground heat source by piping in heat energy to provide a home with HVAC and water heating. A geothermal heat pump thereby acts as central heating and/ or a system that can replace/ augment traditional HVAC systems.



a geothermal heat pump uses the heat generated below the earth's surface for HVAC for a property

Geothermal heat pump systems significantly reduce fossil fuel use and greenhouse gas emissions, by reducing energy demands and consumption; and by replacing energy-intensive, fossil fuel-based systems with renewable energy systems. **Geothermal heat pumps** are very environmentally friendly, generating no emissions or pollution.

Geothermal heat pumps can produce results that are more than double the energy efficiency and cost efficiency of even the best fossil fuel-based HVAC technologies. This is another renewable energy-based technology that significantly reduces energy bills, as well as saving energy. The use of **geothermal heat pumps** has routinely cut heating bills in half while operating with significantly greater efficiency than traditional HVAC systems.

In addition to **geothermal heat pumps**, clean energy sources of heating and cooling for your property, which are also energy efficient, are *electric air source heat pumps* (a clean energy source, as they work from electricity- but *not a renewable energy source*, just an electric source). **Electric heat pumps** are gaining in popularity worldwide, as an environmentally-friendly solution to heat homes efficiently. **Electric heat pumps** can replace gas-fired furnaces and replace conventional HVAC units with a clean, electric option.

Because the cost of **electric heat pumps** is far lower than that of geothermal heat pumps, electric heat pumps are much more common than their renewable energy-based counterparts. This is true to the point where the words "heat pump" are generally assumed to refer to **electric heat pump** technology, not geothermal-based technology (generally, in most markets worldwide).

However, it must be noted that it is only the up-front capital cost of **electric heat pumps** that are much more affordable, not the long-term marginal costs. With **electric heat pumps**, the costs of electricity must be factored in, as there is a constant need for electricity in order to run the heat pumps. Geothermal heat pumps represent low marginal costs, and long-term cost savings, as the technology is based on free, abundant renewable energy.

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